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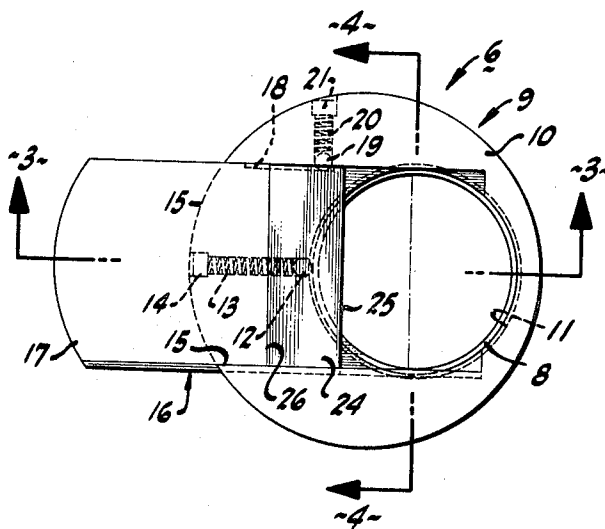
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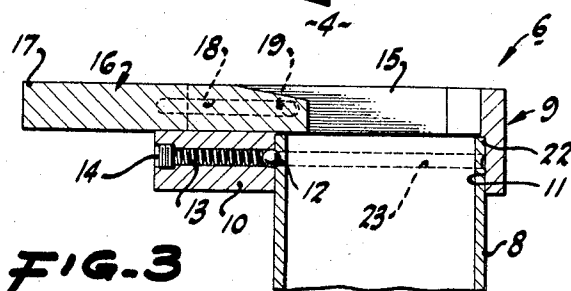
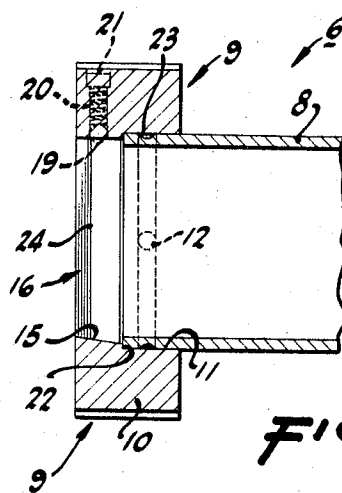
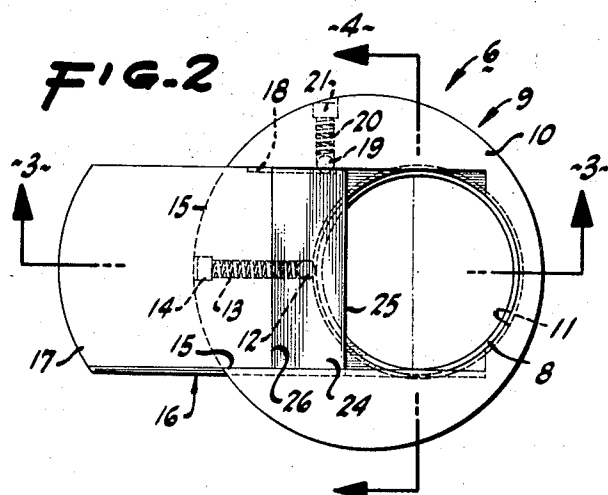
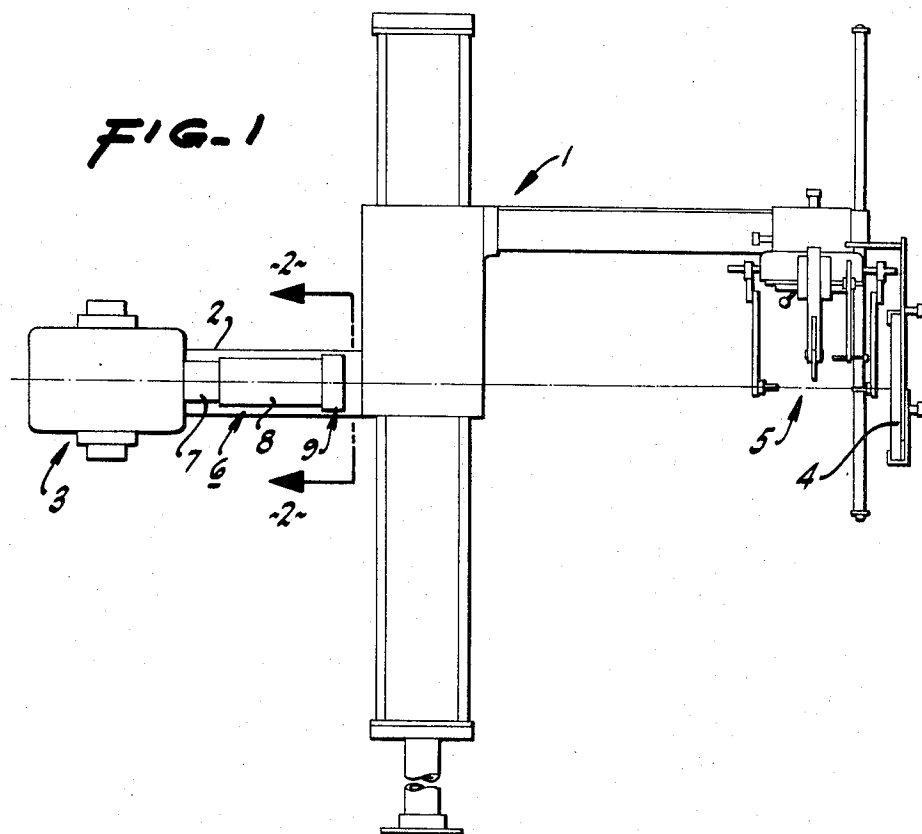
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[54] **FILTRATION HEAD FOR X-RAY MACHINE
WHICH IS REMOVABLY AND ROTATABLY
SUPPORTED ON THE X-RAY COLLIMATOR**
5 Claims, 4 Drawing Figs.

[52] U.S. Cl..... **250/86,**
250/65, 250/105
[51] Int. Cl..... **G03b 41/16**
[50] Field of Search..... 250/65, 86,
105

ABSTRACT: A filtration head adapted for attachment to a tubular collimator on an X-ray machine or cephalometer in the form of a ray-absorbent filter of varying thickness adjustable to produce an image clearly defining the hard and soft tissues of the head or body along and adjacent to profiles of the head or portion of the body under examination to different distances from said profiles.





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FILTRATION HEAD FOR X-RAY MACHINE WHICH IS REMOVABLY AND ROTATABLY SUPPORTED ON THE X-RAY COLLIMATOR

BACKGROUND OF INVENTION

In the normal making of X-ray images, the hard tissue is shown with some distinguishing characteristics thereof, but the soft tissues, such as the flesh and skin are not shown in the same film with clarity suitable for use by orthodontists or in plastic surgery. Attempts to accomplish the desired results have been usually restricted by to making changes in the kilovolts and milliamperes utilized for the rays. By this system, where the hard tissue shown is satisfactory, none of the soft tissue will appear.

In order to control the rays for covering the desired areas free from objectionable scatter, either single or telescopic collimators in the form of one or a telescopically-assembled pair of tubular collimators is employed; the amount of area to be included on the film usually determines the distance of the collimator from the subject. A telescopically-arranged pair provides for an adjustment in the distances without a change in collimators.

By the use of the present invention, the desired contrast on the film between the soft and hard tissues in single exposures are defined to provide clearly defined profiles of each, and the image spaced from the profiles smoothly and progressively fades or blends to avoid an undesirable abrupt edge in the image on the film.

Also, any profile image may be produced, such as front, back, or side view profiles of either side without additional elements other than a single filtration device, which device is readily adjustable on the collimator, both to the profile to be reproduced on the film, and as to the amount of the body to be reproduced other than the portions along the profiles.

SUMMARY

This invention provides a filtration head adapted to be attached to a tubular collimator on an X-ray machine, which head includes a slide of opaque metal having substantially the characteristics of aluminum in permitting the passage of X-rays therethrough but absorbing a percentage of said X-rays.

By positioning the slide across the exit end of the collimator to a degree that will only absorb rays along the outer surface of the body of a person, to approximately the underlying hard tissues such as the bones, the soft tissues between the outer surface and the bones will be clearly seen in the image that is produced.

As a method, as well as structure, provision is made in the slide for progressively increased absorption of the rays from the internal hard tissues to the outer surface of the body so that the outline along the skin is clearly defined, as well as the bones, in a single exposure, free from a confusing line of demarcation defining the point where absorption of the rays commences.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side-elevational view of a conventional cephalometer, so showing my invention on collimator tube on the cephalometer.

FIG. 2 is an enlarged outer end elevational view of the collimator and the device of this invention as seen from line 2-2 of FIG. 1.

FIG. 3 is a cross-sectional view taken along line 3-3 of FIG. 2.

FIG. 4 is a cross-sectional view taken along line 4-4 of FIG. 3 in which part of the collimator tube is shown in cross section.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The present invention is not restricted to any particular types of X-ray machines or cephalometers. The cephalometer illustrated comprises a vertical standard or post generally

designated 1, adjustably supporting thereon a horizontal arm 2 carrying a conventional X-ray machine 3 thereon, offset to one side of a vertical plane in which the post is positioned so as to direct its rays past the post and onto film held in a cassette 4 supported on an arm or post 1 projecting to the opposite side of the post from machine 3. Positioning means generally designated 5, adjacent to the cassette, is adapted to position the head of a person, it being understood, however, that the relationship between the X-ray machine, a cassette, and the body, or portion of the body to be subjected to the X-rays is of the main interest. Obviously, different means may be used to support the machine 3 and the cassette.

A telescopic conventional extension tube generally designated 6 is shown on machine 3, directed toward cassette 4. The tube illustrated may be telescopic, having an inner tube 7 releasably secured on the machine 3, and an outer tube 8 telescopically supported on tube 6 coaxial with the latter, whereby the distance between the outer end of tube 8 and the cassette or the portion of the body to which the X-rays are subjected may be varied to control the scatter of the rays. Obviously a single tube may be used, or different lengths single tubes may be secured to the machine 3, provision for the substitution of different tubes being conventional.

A filtration head, generally designated 9, is supported on the outer end of the tube 8. This head 9 comprises a body 10 (FIGS. 2-4) formed with a circular opening 11 adapted to closely, but slidably, receive the outer end of the outer tube 8, or the outer end of a single extension tube if the extension 6 is not telescopic. The body 10 is frictionally held on tube 8 by a ball 12 that, in turn, is yieldably urged against a side of tube 8 by a spring 13 held in a passageway in said body that extends radially relative to the axis of opening 11. A screw 14 threaded into the outer end of said passageway yieldably holds the ball against one side of the outer end of tube 8 so that the body 10 is not only held on tube 8 but the head will be rotatable on tube 8 and will be frictionally held stationary on the tube in any degree of such rotation relative to the latter.

Body 10 is formed with a guideway 15 (FIGS. 2, 4) at one side of opening 11 extending to the latter, having parallel sides extending approximately from two opposite sides of said opening 11 (FIG. 2). A filtration slide 16, having parallel side edges complementary to the sides of guideway 15 is reciprocably slidably held in said guideway for movement radially of opening 11. This slide preferably has an extension 17 that is adapted to project to one side of body 10 at all times to enable an operator to grasp the extension between the fingers of a hand for sliding the slide 16 to different distances across opening 11.

Guideway 15 is formed in the side of body 10 that faces outwardly of tube 6, or outer tube 8, and one side or both of the sides of said guideway, the side edges of the slide complementary thereto, may be slanted slightly in a direction generally convergently outwardly from the sides of opening 11 (FIG. 4), dovetail fashion, so as to retain the slide in the guideway.

One of the side edges of slide 16 is formed with a groove 18 (FIGS. 2, 3) into which a ball 19 is yieldably seated by a spring 20 positioned in a passageway formed in body 10 and extending perpendicular to said groove. A screw 21 threaded in the outer end of said passageway retains said ball in frictional engagement with slide 16 for frictionally holding the slide 16 stationary at any position in its reciprocable movement. The ends of said groove 18 determine the limits of said reciprocable movement of the slide. When the slide is at its outermost position relative to opening 11, its end edge, which is straight and extends at a right angle to the side edges of the slide, may project only slightly across one side of opening 11, or it may clear the opening, and when at its innermost position, the end edge of the slide at said opening may extend approximately across one-half of the opening (FIG. 2).

A slight shoulder 22 (FIG. 4) at the inner end of one side of guideway 15, or any other suitable means, may be left to provide a stop to prevent the outer end of tube 8 from abutting

the slide 16 and to position the outer end of tube the tube 8, although the outer surface of the outer end of tube 8 may be formed with a raceway 23 (FIG. 4) in which ball 12 is adapted to be releasably seated, and which will also position the head 9 on tube 8 and will releasably hold the head in said position.

From the foregoing description it is seen that the slide 16 may be intentionally withdrawn from the head 10 by application of extra force, and in the same manner head 9 may be removed from the tube 8 in the event conventional X-ray images are desired.

The inner end portion 24 (FIGS. 2, 3) of slide 16 that is adapted to extend over opening 11 is of progressively increasing thickness from its inner end edge 25 toward the opposite outer end edge of the slide. The side of the slide that faces the bottom of the slideway is preferably flat, and the opposite side of portion 24 is the side that is relieved from line 26 (FIGS. 2, 3) to the end edge 25 in a direction longitudinally of said slide to progressively and uniformly reduce the thickness of said inner end portion 24.

It has been found that an aluminum slide having a thickness of approximately 9 cm. along its inner edge and approximately 13 cm. at line 26, which line is approximately 24 cm. distance from said inner edge produces the desired results where the inside diameter of the tube 7 is approximately 70 cm. in diameter and the kilovoltage and milliamperes are such as to produce the desired image of the hard tissue. Thus, a progressively increased thickness from edge 25 at the rate of approximately one increment for each six thereof longitudinally of the slide or filter has been found to be satisfactory.

As an example, in the making of an image of a portion of the head of a person along the profile of the face, the filtration head 9 is positioned on the outer end of the tube 8 and is rotated so that the inner edge of the slide 16 extends substantially lengthwise said profile. The slide is then adjusted so as to extend partially across the opening to the degree desire for the relative areas of adjoining soft and hard tissues that are to be reproduced on the film.

The generally wedge-shaped filtration element or slide 16 has been found to provide a blending of the rays passing through opening 11 along the line defined by the inner edge of the slide, instead of there being an abrupt change, along such line, thus enabling the surgeon to study the image free from distortion or confusion.

One importance of the present device in the field of orthodontics is that the X-ray images produced by its use enables the orthodontist to accurately and quickly determine the relationship between the soft tissues that determine the character of the features and the underlying hard tissues. Some modifications that must be made in the hard tissues, by corrective surgery, may be made in a manner that would objectionably change the features of the face in the absence of the clear and accurate image produced by use of the present invention clearly showing the foregoing relationship.

The rotation of the filtration head 9 on the tube, enables the production of an image along any profile portion of the body, whether vertically or horizontally extending, including the hard tissue adjoining the profile.

While the invention has been described in detail, it will be apparent that improvements and modifications may be made without departing from the scope of the invention as defined in the appended claims.

I claim:

1. A filtration head for positioning on the outer end of the cylindrical extension tube on the collimator of an X-ray machine comprising:

- a. a body formed with an opening having a central axis and through which opening the rays of said machine are adapted to be projected,
 - b. a metal plate on said body move movable from one side of said opening, substantially uncovering the latter, to different positions extending partially across said opening from said one side, leaving an unobstructed remainder in said opening,
 - c. said body being formed with a guideway extending normal to said axis having parallel sides extending from two opposite sides of said opening,
 - d. said plate comprising a generally rectangular slide member supported in said guideway by said opposite parallel sides for reciprocable movement on said body toward and away from said axis, and
 - e. means on said body in frictional yieldable engagement with said slide for frictionally holding said slide in each of said different positions,
 - f. said opening including a portion having cylindrical sides extending axially of said opening from one side of said plate for slidably and removably receiving said outer end of the cylindrical extension tube of a collimator for rotatably supporting said body on said outer end for rotary movement to different adjusted positions.
2. In a filtration head as defined in claim 1 stop means on said body for limiting movement of said body on said cylindrical tubular extension toward said extension when said extension is within said portion of said opening to space said plate a uniform distance from said extension.
3. A filtration head as defined in claim 2:
- a. means on said body in a position for yieldably engaging said cylindrical tubular extension when said extension is within said portion of said opening for yieldably holding said body stationary on said portion in any of said adjusted positions,
 - b. said plate being of progressively increasing thickness from said unobstructed remainder of said opening in a direction toward said one side of said opening, whereby the degree of absorption of rays by said plate, when said body is on said tube and said rays are projected through said tube, will be progressively greater as the thickness of the portion of said plate extending across said opening increases so that adjoining hard and soft tissues onto which said rays may be projected will, when said body is in any one of its adjusted positions, be exposed for substantially optimum images of both, by a single exposure.
4. The filtration head as defined in claim 1, in combination with:
- a. a collimator including said cylindrical extension tube having an inner end adapted to be secured on an X-ray machine with said outer end opposite to said inner end,
 - b. said portion of said opening being in slidable engagement with the radially outwardly facing cylindrical surface of said outer end and said body for rotatably supporting said body on said outer end,
 - c. means on said body in releasable engagement with said tubular extension for releasably holding said body on said extension.
5. In the combination as defined in claim 4; said last-mentioned means including a radially inwardly spring-urged element in said body yieldably movable into said portion of said opening and an annular radially outwardly opening raceway formed in said radially outwardly facing surface of the cylindrical outer end of said tube in which said radially inwardly spring-urged element is yieldably urged.